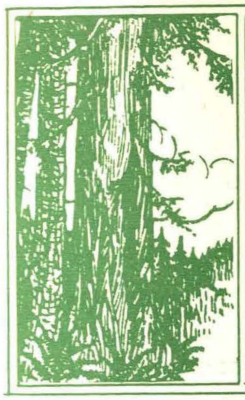
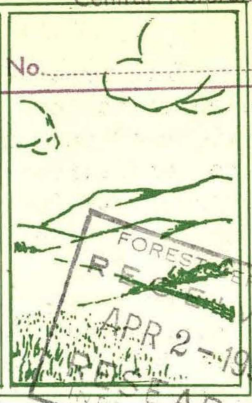
INTERMOUNTAIN STATION
Central Reference File
No. 0.73
X 2,33



FOREST RESEARCH NOTES

U.S.DEPARTMENT OF AGRICULTURE
FOREST SERVICE
CALIFORNIA FOREST AND RANGE
EXPERIMENT STATION *

STEPHEN N. WYCKOFF, Director



FOREST SERVICE
RECEIVED
APR 2 - 1951
RESEARCH
INTERMOUNTAIN

No. 77 March 15, 1951

UNIT AREA CONTROL IN CALIFORNIA FORESTS

By William E. Hallin, Forester

"Unit Area Control"--A new term is heard by California foresters. It is based upon research by the California Forest and Range Experiment Station. Its application in the region is believed to offer the most realistic approach to sustained yield forestry. This article outlines the silvicultural basis of unit area control and some of the pertinent points in its application.

Unit area control is a silvicultural concept in which the essential characteristic is "detailed control of stocking on small areas." The basic idea is not new. In some localities it has been referred to as forestry by the acre. Duncan Dunning[1/] selected the term to name the concept when he developed its application to California forests.

"Unit area" and "control"--the two parts of the term--are the keys to understanding this concept. "Unit area" was selected because silviculture must fit stand conditions that are natural units. Forest stands normally break down into homogeneous stand units, or unit areas, varying in size from a fraction of an acre to many acres. Characteristics commonly determining the homogeneity of these unit areas are: Age class, species composition, stocking, and presence or absence of seed trees.

"Control" was selected because it most aptly describes the aim of the silvicultural treatments applied to the unit areas. Control of the ground by a desirable or valuable tree species rather than by brush or inferior tree species is of first importance. Also, control means continuously maintaining adequate stocking of a desirable species growing at a rate commensurate with the site. Silvicultural treatments applied at the proper time are the means by which the forester controls the stand.

1/ Formerly Division Chief, Division of Forest Management Research, California Forest and Range Experiment Station, now retired.

* MAINTAINED AT BERKELEY, CALIFORNIA, IN COOPERATION WITH THE UNIVERSITY OF CALIFORNIA.
Agriculture--Berkeley

INT - FILE COPY

Unit area control is in sharp contrast to the widely used forms of tree selection. Silviculture is applied according to the needs and condition of each unit area of the stand rather than tree by tree according to generalized rules. A tree selection system of cutting may, however, be appropriate for some unit areas of some species, for example, in an all-age condition class of the tolerant white fir.

There is a definite distinction between the basic concept of unit area control and the specific techniques or treatments used for specific units. Unit area control as a term was first used in connection with a cutting trial in the sugar pine-fir type; consequently, many foresters think the term refers merely to the technique used in sugar pine management. This is not the case. Applying silviculture by unit areas is appropriate and desirable for other major types as well. So far, however, techniques have been developed only for pine and mixed-conifer types in the Sierra Nevada. The remainder of this discussion is concerned with these types.

Basis of Unit Area Control

Thirty years of research in the ponderosa pine and mixed conifer forests of the Sierra Nevada have shown that previous methods of silviculture were not providing adequate restocking of pine. Analysis of records indicated a new approach was necessary. From this work, procedures that gave most promise of success were formulated by Duncan Dunning. These procedures are techniques for applying unit area control in the ponderosa pine and mixed-conifer forests. Large-scale trial and demonstration of these applications are under way in ponderosa pine at the Blacks Mountain Experimental Forest and in sugar pine-fir at the Stanislaus Experimental Forest. At both places small-scale studies are being carried on to implement and improve the application of unit area control.

In managing forest stands procedures to be followed depend on (1) objectives of the land manager, (2) silvical characteristics of the species, (3) condition of the stand when treatment starts, and (4) treatment required to obtain the desired results.

Objectives of Management

What the land manager wants is the first controlling factor in determining what is done to the forest. The land manager must decide the species desired, the acceptable degree of stocking, the size and kind of product desired, and make the other customary managerial decisions.

In the ponderosa pine and mixed-conifer types a primary objective of land managers is to grow large size sugar or ponderosa pine peeler logs or sawlogs. If sustained production with a growth rate commensurate with the site capacity is desired, conversion of the unmanaged stand to a regulated stand--a forest with each age class through rotation or harvesting age, uniformly represented and adequately stocked--is an essential objective.

Silvical Characteristics

Some of the important silvical characteristics of sugar and ponderosa pine that affect their management are: (1) They are intolerant species and grow best in even-aged groups. (2) They prefer bare mineral soil for germination. (3) If pine starts free of competition, its initial growth is rapid and usually it is able to compete successfully with fir, brush, and other vegetation that may subsequently become established. (4) For best growth, thinnings and cleanings are usually necessary. (5) California ponderosa and sugar pine do not readily establish themselves under brush and white fir. (6) Where they have become established under brush or white fir they do not develop properly unless released from this competition. (7) Pine seeds are the preferred food of numerous rodents commonly found in our forests. (8) Pine does not prune itself of branches naturally during practical rotation periods.

Site quality, through its effect on growth rates, has an important effect on acceptable stocking, length of rotations, and final yield.

Condition of the Stand--Condition Classes

Ponderosa pine and sugar pine stands when considered by large areas are all-aged; however, when the forest is examined closely the trees are seen to occur in even-aged groups, usually small in size and homogeneous in respect to stocking, species, etc. Dunning has called these groups condition classes.

The objects of a classification by condition classes are: (1) To subdivide the forest or working circle into natural unit areas sufficiently small and homogeneous for practical, uniform treatments (harvest cutting, regeneration, stand improvement, etc.). (2) To determine (a) which unit areas have existing stands adequate to carry as growing stock and, if they do, whether or not they should be subjected to an improvement cut, and (b) which unit areas have stands that should be clear cut and the unit regenerated. (3) To provide the basis for the cutting plan, cutting budgets, allowable cut, and other treatments for a working plan most likely to accomplish stand regulation in the conversion period.

The basis for a condition classification is the naturally occurring group stand structure. Dominant trees are used as indicators in condition classification because they make up over 80 percent of the stand in board-foot volume but only about 40 percent of the stand in numbers of trees. The criteria for recognizing and classifying condition classes are age, species, degree of stocking relative to the stand aimed for in regulation, and--for unit areas needing regeneration--the presence or absence of seed trees and the presence or absence of brush needing eradication.

The age classes commonly used for the overstory are: (1) Old--300 years plus--tree Class 5 in Dunning's tree classification system; (2) mature--150 to 300 years--tree Class 3; (3) immature--75 to 150 years--tree Class 1. The age or size classes commonly used for the understory are: (1) Poles--4 to 12 inches d.b.h.; (2) seedlings and saplings--trees under 4 inches d.b.h.

The species to which the unit area is to be primarily designated is based on the relative number of dominants. If a third or more of the dominants are sugar pine, the species for the unit is designated as sugar pine. If a third or more of the dominants are ponderosa pine but less than a third sugar pine the species for the unit is designated ponderosa pine, and so on down the list of species in the order of their desirability. Although this species designation is for the purpose of classifying the unit areas at the time of inventory or treatment, it commonly indicates the species to be favored on the particular unit area for the conversion period. With favorable conditions, however, the forester will treat some unit areas so as to change the species to more valuable ones.

Stocking is rated as adequate or inadequate on the basis of a minimum stocking that is acceptable to the land manager. On experimental forests in the better sites a minimum stocking of 50 percent of site capacity has been used.

Seed trees are rated as adequate or inadequate for old or mature unit areas without adequate advance growth. Seed trees should be around the border of the unit area to be regenerated. The number and size required varies with the species.

Brush requiring eradication is rated as present or absent on unit areas needing regeneration.

Recognition of condition classes is not unduly complicated when it is viewed in terms of these few criteria. For any specific unit area the following questions should be answered: (1) What is the age class of the overstory? (2) What is the species composition? (3) For immature and mature age classes, is the stocking acceptable to carry as a reserve? (4) Is there an understory present? (5) What is the species composition of the understory? (6) Is the stocking of the understory adequate? (7) If the understory is inadequately stocked or absent, are there adequate seed trees? (8) If the understory is inadequate or absent, is brush needing eradication present or absent?

Unit areas of the different condition classes vary in size from a fraction of an acre to several acres in size. On 200 acres used in the cutting trial of sugar pine-fir on the Stanislaus Experimental Forest, the average size of condition-class units was approximately 3/4 of an acre. Figure 1, at the end of this report, is a map of 6 acres of this area. It shows some of the commonly found classes and the typical variation in size. Figure 2 shows a typical profile of the stand.

Treatments

In the application of unit area control, each unit area of a specific condition class is given its appropriate cutting and all other necessary treatments at the proper time. The immediate objective is to keep control of the ground with trees. As previously mentioned, the long-time objective is to convert the forest into a regulated stand having each age class through rotation age uniformly represented with adequate stocking and proper growing conditions. The main initial treatments to be applied are as follows:

Cutting for natural restocking is carried on in unit areas of old-age condition classes with inadequate advance growth, with suitable seed trees present, and during a year of a good seed crop. These condition class units are clear cut, but seed trees are left around the border of each unit. Rodents are controlled with lethal bait. Brush is piled and burned. Competing vegetation is eradicated, and the bare mineral soil exposed as a seedbed. If natural regeneration fails the unit area is planted at once before brush and other vegetation invades it.

Cutting for artificial restocking is carried out in the unit areas of old-age condition classes with inadequate advance growth, but with suitable seed trees absent or no seed crop is sight. These condition classes are clear cut. Slash is piled and burned. Competing vegetation is eradicated. The areas are then planted. Because of the infrequency of good seed crops a high proportion of the old condition classes may need to be regenerated by artificial means.

Timing is especially important in securing either natural or artificial reproduction. Once an area has been prepared for reproduction, it should be restocked at once, otherwise brush and other competing vegetation will invade and rapidly take control of the ground. Hence, it is vital that planting stock be available when regeneration cuts are planned, either for planting the entire area or for fill-in planting where natural reproduction fails.

Cutting for release is carried on in unit areas of old-age condition classes with adequate advance growth. The overstory is clear cut to release young growth; cutting is followed up with pruning, thinning, and other stand improvement measures.

Improvement cuts are made in young but merchantable stands (immature and mature age classes). The occasional old, malformed, or defective trees are removed to improve the condition of the stand.

On areas dedicated to sugar pine management ribes eradication also is essential.

The treatments applied to some typical condition classes are shown in Figures 1 and 2.

Application of Unit Area Control

In applying unit area control a detailed inventory and an adequate management plan are highly desirable, just as for any type of silvicultural method. The inventory can be made on a sampling basis as for other methods. A map is not essential. Areas of condition classes can be sampled by line transects, and volumes sampled with small plots. Unit area control treatments, like tree selection, can be applied even though an inventory and adequate plan are lacking. Each condition-class unit can be marked for cutting as it is reached. But an inventory and a management plan cannot be deferred if proper progression towards a regulated stand is to be accomplished.

Calculating the allowable cut and preparing the cutting plan are simplified with an inventory by condition classes. The deficiencies or excesses in the different age classes are readily shown. The condition classes can be sorted out into their proper place in the cutting plan in order to provide for a sustained cut and progression toward a regulated stand. Because the condition classes are usually even-aged, conventional yield tables can be used for growth prediction.

Short cutting cycles are desirable in order to maintain proper control of the stand. In converting virgin old-growth stands to a regulated stand, the large volume of overmature trees may complicate the task of keeping the first cutting cycle relatively short. In applying unit area control the length of the first cutting cycle can be kept short by deferring the cutting of some of the more-thrifty or less-decadent unit areas of old-age condition classes. It should be remembered, though, that when release or regeneration cuts of old-age condition classes are deferred, it generally will be desirable to remove the few trees that obviously would not survive until the next cut.

The problems of logging are no different than in other systems of cutting. Logs must be efficiently moved to the landing and advance growth and reserve trees must be protected from excessive logging damage. Advance plans for sale areas or cutting units are desirable for both silvicultural and logging considerations with any system of cutting. The desirability, while no greater, is more obvious for unit area control, in which a variety of treatments must be integrated.

Conclusion

Unit area control, developed by Duncan Dunning for application to California forests, is believed to give the most promise for successful management of these forests. It is a dynamic, growing process: as present trials are continued and new trials of it started, techniques and procedures will be modified and improved upon. Stripped to essentials, unit area control is, with due consideration of the silvical characteristics of trees, the common sense application of silviculture to the naturally occurring unit areas of the forest stand.

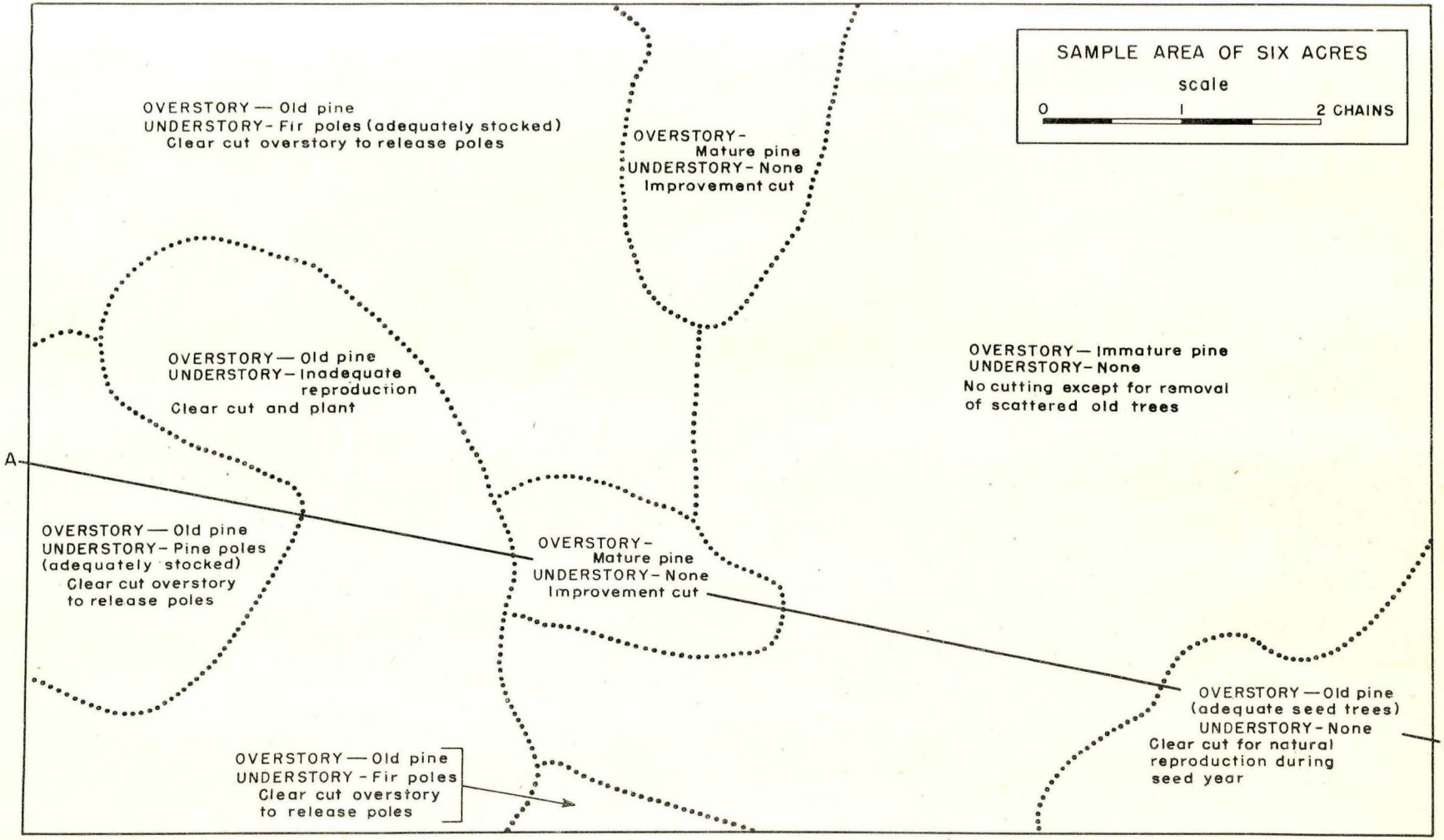


Figure 1 - Condition classes and first treatment on a portion of Stanislaus Experimental Forest.

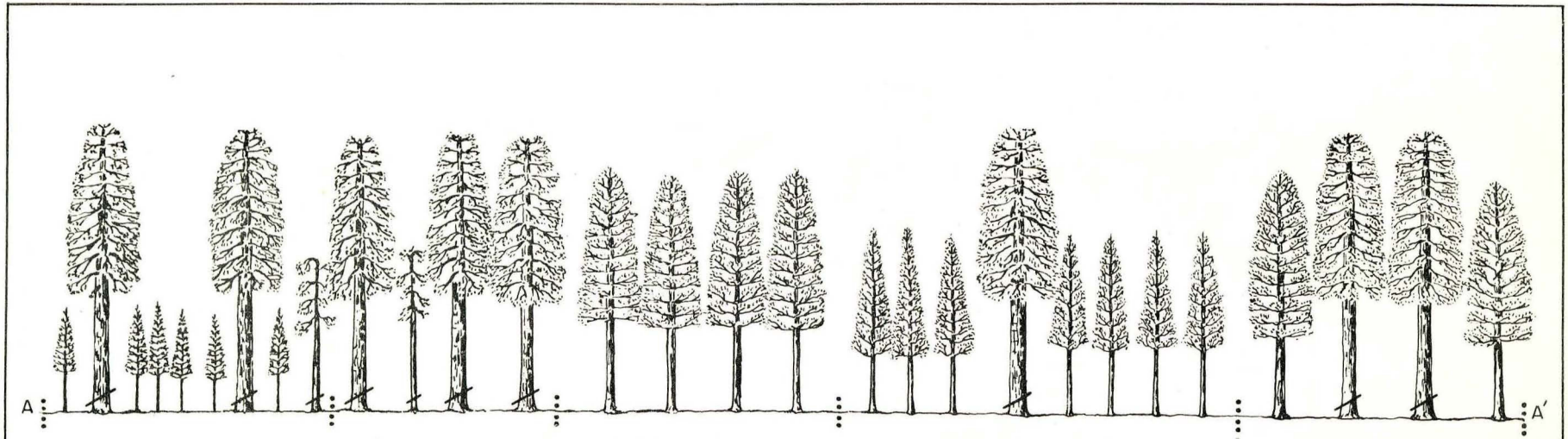

A
A′
OVERSTORY — Old pine
UNDERSTORY- Pine poles
TREATMENT— Group release cut, prune crop trees.
OVERSTORY — Old pine
UNDERSTORY- Inadequate reproduction
TREATMENT — Clear cut, dispose of slash, eradicate brush, plant.
OVERSTORY— Mature pine
UNDERSTORY- None
TREATMENT — Where present remove occasional old or malformed or defective trees to improve stand condition.
OVERSTORY— Immature pine
UNDERSTORY- None
TREATMENT— Cut scattered old trees.
OVERSTORY — Old pine
UNDERSTORY- None
TREATMENT — Clear cut for natural reproduction during seed year, leave seed trees around border, poison rodents, pile slash, eradicate brush, expose mineral soil.

Figure 2 - Profile of stand along line A—A′, figure 1.